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# Seven new records of foliicolous lichens from Vietnam

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Abstract — Seven foliicolous species growing in tropical regions of Vietnam are reported as new to the country. Described are *Arthonia accolens, Calenia aspidota, Calopadia subcoerulescens, Coenogonium minimum, Fellhanera rhapidophylli, F. semecarpi,* and *Porina subnitidula.* Among them, *Coenogonium minimum* and *Porina subnitidula* are reported for the first time from the paleotropics.

Key words — *Ascomycota,* geographical distribution, lichen-forming fungi, taxonomy

## Introduction

The present paper, which is a further report on the taxonomic study of foliicolous lichens from Vietnam by Nguyen et al. (2010, 2011), describes seven species newly recorded from three different localities [Thác Đray Sáp (= Dray Sap waterfall), Vườn quốc gia Bạch Mã (= Bach Ma National Park), and Vườn quốc gia Phong Nha-Kẻ Bàng (= Phong Nha Ke Bang National Park)] in Vietnam. The discovery in Vietnam of *Coenogonium minimum* and *Porina subnitidula,* previously known only from the Neotropics, provides further information about their distribution in southeastern Asia. In addition to the newly recorded species, the authors also collected previously reported (by Santesson 1952, Vězda 1977, Farkas & Sipman 1993, 1997, Lücking & Vězda 1998, Aptroot & Sparrius 2006) the foliicolous lichens *Bacidina apiahica* (Müll. Arg.) Vězda, *B. pallidocarnea* (Müll. Arg.) Vězda, *Byssoloma chlorinum* (Vain.)

Zahlbr., *Calopadia puiggarii* (Müll. Arg.) Vězda, *Coenogonium dilucidum* (Kremp.) Kalb & Lücking, *C. subluteum* (Rehm) Kalb & Lücking, *Echinoplaca epiphylla* Fée, *Porina corruscans* (Rehm) R. Sant., *P. diaphana* Vězda, *P. nitidula* Müll. Arg., *Sporopodium phyllocharis* (Mont.) A. Massal., *Strigula orbicularis* Fr., *S. nitidula* Mont., and *Trichothelium alboatrum* Vain. The most common and widely distributed species found during the survey were *Bacidina apiahica, Calopadia puiggarii, Coenogonium dilucidum, Porina nitidula,* and *Strigula nitidula.*

This is the first report of lichens from central Vietnam. Earlier workers (Santesson 1952, Vězda 1977, Farkas & Sipman 1993, 1997, Lücking & Vězda 1998, Aptroot & Sparrius 2006) have reported Vietnamese lichens mostly from the northern parts of the country. Surveys of the several provinces still left unexplored will definitely contribute further to our knowledge of the Vietnamese lichen flora. Brief taxonomic descriptions, chemical and ecological notes, and comments are provided below for each of the newly recorded species.

## Materials & methods

The lichen samples were collected from three different localities between 22 July 2006 and 08 February 2010. The study area covers the three Vietnamese provinces Daknong, Quang Binh, and Thua Thien Hue. After drying at room temperature, the lichen samples were identified using stereo and light microscopes: a NIKON Eclipse E200 dissecting microscope was used for identifying morphological characters of thallus, reproductive structures, color, size and shapes, while an OLYMPUS BX 50 compound microscope was used for studying the anatomy of thalli and fruiting bodies. All measurements were made from material mounted in water and stained in lactophenol cotton blue (LCB). An average of ten measurements per structure was recorded for the sizes of thallus, ascomata, and ascospores and the thicknesses of hymenium, hypothecium, exciple, and involucrellum. Only free ascospores lying outside the asci were measured. Ascospore dimensions are generally presented as minimum value observed – maximum value observed. Spot test reactions were carried out on hand sections of thalli and apothecia under the compound microscope. Iodine (I) was used to check the color reactions of the ascus wall and the hymenium. Thin Layer Chromatography (TLC) was performed in solvent system C (Toluene:Acetic acid 85:15) as described by Orange et al. (2010). Terminology used in this study follows Lücking (2008). Vouchers have been deposited in the herbarium of the Lichen & Allied Bioresource Center at the Korean Lichen Research Institute (KoLRI), Sunchon National University, South Korea.

## New records

***Arthonia accolens*** Stirt., Proc. Roy. Phil. Soc. Glasgow 11: 105, 1879

Thallus dispersed into rounded patches, smooth, 2–20 mm across, ecorticate, brownish green. Photobiont cells rectangular in radiate plates. Apothecia adnate, rounded, 0.1–0.3 mm diam., dark brown. Hypothecium 2–4 μm high,

brown. Hymenium pale brown. Asci globose, 15–20 × 13–15 µm, 8-spored. Ascospores obovate, hyaline, 2-septate, 10–12 × 3–4 µm, distal cell enlarged.

Chemistry — Spot test reactions: thallus and apothecia K–, C–, KC–, P–, N–. Epithecium N–. Secondary metabolites: none detected.

Distribution & ecology — Pantropical (Lücking 2008); new to Vietnam. At the collection site the species was found growing on the understory leaves in lowland tropical rain forest along with *Coenogonium dilucidum* and *Porina* spp.

Specimen Examined – **VIETNAM**: **Thua Thien Hue Province**: Vườn quốc gia Bạch Mã, 16°12′55.50″N, 107°51′40.20″E, alt. 685 m, on leaf of *Ochna* spp., 08 February 2010, T. Nguyen 100001 (KoLRI).

Remarks — *Arthonia cyanea* Müll. Arg., another *Arthonia* species known from Vietnam, differs in having bluish to greenish gray, white pruinose apothecia. The apothecia in *A. accolens* are light to dark brown colored and never pruinose. The species can also be confused with *A. leptosperma* (Müll. Arg.) R. Sant., which differs in having smaller, 1-septate ascospores and a continuous thallus with net-like photobiont. For further descriptions of *A. accolens,* see Lücking (2008).

***Calenia aspidota*** (Vain.) Vězda, Folia geobot. phytotax. 19: 195, 1984

Thallus dispersed into rounded patches, 5–13 mm across, greenish gray, 47–80 µm thick, cortex formed by rounded cells, strongly inflated with calcium oxalate crystals, white. Setae not observed. Apothecia immersed, zeorine, rounded, 0.2–0.5 mm diam. and 70–120 µm high; disc whitish gray with white pruina; margin distinct, irregularly lobulate, white. Hymenium 90–100 µm, hyaline. Epithecium 3–5 µm thick, with algal layer. Asci ellipsoid, 70–85 × 20–35 µm, single spored. Ascospores hyaline, muriform, 50–80 × 15–30 µm. Hyphophores white, 0.2–0.4 mm high.

Chemistry — Spot test reactions: thallus and apothecia K–, C–, KC–, P–. Secondary metabolites: none detected.

Distribution & ecology — Pantropical (Lücking 2008); new to Vietnam. At the collection site the species was found growing on the understory leaves in lowland tropical rain forest along with *Calopadia puiggarii* and *Porina nitidula*.

Specimen Examined – **VIETNAM**: **Daknong Province**: Thác Đray Sáp, 12°32′21.39″N, 107°53′19.80″E, alt. 399 m, on leaf, 22 July 2009, Y. Joshi & T. Nguyen 090183 (KoLRI).

Remarks — *Calenia thelotremella* Vain., another *Calenia* species known from Vietnam, differs in having transversely septate ascospores, a verrucose, pale greenish, or yellowish gray thallus, and epruinose, yellowish gray apothecia. The species can also be confused with *C. bullatinoides* Lücking, which differs in

having 2–4-spored asci and smaller hyphophores with blunt, darkened apices. For further descriptions of *C. aspidota,* see Lücking (2008).

***Calopadia subcoerulescens*** (Zahlbr.) Vězda, Sched. Lichenes Selecti Exsiccati Fascicle 88: 3, no. 2185, 1988

Thallus dispersed into rounded patches, 10–15 mm across, smooth, pale greenish gray. Apothecia rounded, 0.2–0.4 mm diam., plane, brownish black; margin thin, prominent, gray. Excipulum 35–40 µm broad, hyaline, paraplectenchymatous. Hymenium 100–120 µm, hyaline. Hypothecium 30–40 µm high, aeruginous. Apothecial base aeruginous. Epithecium 7–10 µm high. Asci 70–95 × 20–25 µm, single spored. Ascospores hyaline, muriform, 70–85 × 15–20 µm. Campylidia not observed.

Chemistry — Spot test reactions: thallus and apothecia K–, C–, KC–, P–. Secondary metabolites: none detected.

Distribution & ecology — Pantropical (Lücking 2008); new to Vietnam. At the collection site the species was found growing on the understory leaves in lowland tropical rain forest at an elevation of 136 m.

Specimen Examined – **VIETNAM**: **Quang Binh Province**: Vườn quốc gia Phong Nha-Kẻ Bàng, 17°28′51.60″N, 106°18′39.10″E, alt. 136 m, on leaf of *Lauraceae* tree, 06 February 2010, T. Nguyen 100028b (KoLRI).

Remarks — *Calopadia puiggarii,* another *Calopadia* species known from Vietnam, differs in having a dark brown hypothecium and grayish brown apothecia. *Calopladia subcoerulescens* always has an aeruginous hypothecium and grayish black to black apothecia. For additional details see Lücking (2008).

***Coenogonium minimum*** (Müll. Arg.) Lücking, Fl. Neotrop. Monogr. 103: 572, 2008

Thallus continuous, smooth, green. Apothecia sessile, rounded, 0.1–0.13 mm diam. Disc concave, yellowish brown, slightly translucent; margin distinct, prominent, concolorous with disc. Excipulum 5–8 µm high, pale yellowish brown. Hypothecium 5–8 µm high, hyaline. Hymenium 40–45 µm high, hyaline. Asci 42–48 × 5–6 µm, 8-spored. Ascospores ellipsoid, 1-septate, 12–14 × 3–4 µm. Pycnidia not observed.

Chemistry — Spot test reactions: thallus K–, C–, KC–, P–. Secondary metabolites: none detected.

Distribution & ecology — Neotropical (Lücking 2008); new to Vietnam. At the collection site the species was found growing along with *Coenogonium dilucidum* on the understory leaves in lowland tropical rain forests between elevations of 136–556 m.

Specimens Examined – **VIETNAM**: **Quang Binh Province**: Vườn quốc gia Phong Nha-Kẻ Bàng, 17°33′07.10″N, 106°18′06.10″E, alt. 556 m, on leaf, 05 February 2010, T. Nguyen 100168h (KoLRI); 17°33′37.10″N, 106°18′06.10″E, alt. 556 m, on leaf of *Rubiaceae*

tree, 06 February 2010, T. Nguyen 100016 (KoLRI); 17°28′51.60″N, 106°18′39.10″E, alt. 136 m, on leaf, 06 February 2010, T. Nguyen 100031, 100066b (KoLRI); 17°33′07.10″N, 106°18′06.10″E, alt. 556 m, on leaf of *Fagaceae* tree, 06 February 2010, T. Nguyen 100081a (KoLRI).

Remarks — *Coenogonium dilucidum, C. disciforme* Papong et al., *C. luteum* (Dicks.) Kalb & Lücking, and *C. subluteum* are the other *Coenogonium* species known from Vietnam. *Coenogonium dilucidum* differs in having wax-colored to pale yellow, slightly concave apothecia; *C. luteum* and *C. subluteum* have larger apothecia (0.2–1.5 mm diam.), while *C. disciforme* differs in bearing numerous disc-shaped isidia. For further descriptions of *C. minimum,* see Lücking (2008).

***Fellhanera rhapidophylli*** (Rehm) Vězda, Folia geobot. phytotax. 21: 214, 1986

Thallus continuous, farinose, greenish gray to green. Apothecia rounded, 12–14 µm diam.; disc plane to slightly convex, grayish brown to dark reddish brown; margin thin, persistent, pale gray. Excipulum paraplectenchymatous, 20–25 µm broad. Hypothecium dark brown. Hymenium colorless, 40–55 µm high. Asci 42–55 × 10–11 µm, 8-spored. Ascospores ellipsoid, 3-septate, 13–16 × 3–4 µm. Pycnidia not observed.

Chemistry — Spot test reactions: thallus K–, C–, KC–, P–. Secondary metabolites: none detected.

Distribution & ecology — Pantropical (Lücking 2008); new to Vietnam. At the collection site *F. rhapidophylli* was found growing on the understory leaves in tropical rain forest along with *F. bouteillei* (Desm.) Vězda.

Specimen Examined – **VIETNAM**: **Daknong Province**: Thác Đray Sáp, 12°32′21.39″N, 107°53′19.80″E, alt. 685 m, on leaf, 22 July 2009, Y. Joshi & T. Nguyen 090094 (KoLRI).

Remarks — *Fellhanera bouteillei*, *F. emarginata* Lücking, *F. microdiscus* (Vain.) Vězda, *F. sublecanorina* (Nyl.) Vězda, and *F. semecarpi* are the other *Fellhanera* species reported from Vietnam. *Fellhanera bouteillei* and *F. semecarpi* differ in having 1-septate ascospores and light-colored apothecia; *F. emarginata* has a reduced exciple and broader ascospores with constrictions at the septa; *F. sublecanorina* has a bluish gray thallus containing isousnic acid and other substances and an apothecium with a well-developed whitish margin; *F. microdiscus* has 5-septate ascospores that are slightly curved and attenuated at one end and an apothecium with a thin but distinct margin. For further descriptions of *F. rhapidophylli,* see Lücking (2008).

***Fellhanera semecarpi*** (Vain.) Vězda, Folia geobot. phytotax. 21: 215, 1986

Thallus dispersed into rounded patches, 3–7 mm across, smooth, greenish gray. Apothecia rounded to irregular in outline, 0.15–0.3 mm diam.; disc plane, ochraceous yellow to reddish brown; margin thin, pale gray. Excipulum

paraplectenchymatous. Hypothecium brown. Hymenium 40–50 µm high, hyaline. Asci 30–40 × 8–10 µm, 8-spored. Ascospores 1-septate, with constriction at septum, 12–15 × 4–5 µm. Pycnidia not observed.

Chemistry — Spot test reactions: thallus K–, C–, KC–, P–. Secondary metabolites: none detected.

Distribution & ecology — Pantropical (Lücking 2008); new to Vietnam. At the collection site the species was found growing on the understory leaves in lowland tropical rain forest along with *Calopadia puiggarii* and *Porina nitidula*.

Specimens Examined – **VIETNAM**: **Quang Binh Province**: Vườn quốc gia Phong Nha-Kẻ Bàng, 17°33′04.20″N, 106°18′03.60″E, alt. 132 m, on leaf of *Cinnamomum*, 05 February 2010, T. Nguyen 100168a, 100168c, 100168e (KoLRI).

Remarks — *Fellhanera bouteillei, F. emarginata, F. microdiscus, F. rhapidophylli* and *F. sublecanorina* are the other *Fellhanera* species reported from Vietnam (Vězda 1977, Nguyen et al. 2010). *Fellhanera emarginata, F. microdiscus, F. rhapidophylli,* and *F. sublecanorina* differ in having 3–5-septate ascospores. *Fellhanera bouteillei* has 1-septate ascospores but differs in its farinose to granulose thallus bearing secondary metabolites (usnic acid, isousnic acid, zeorin and sometimes asemone). For further descriptions of *F. semecarpi,* see Lücking (2008).

***Porina subnitidula*** Coliín & A.B. Peña, Phyton (Horn) 44: 176, 2004

Thallus dispersed into irregular patches, brownish gray. Perithecia black, sessile, hemispherical with base spreading, 0.4–0.6 mm diam., glabrous, pure black, slightly shiny. Excipulum 20–30 µm thick, brownish black, K+ black. Involucrellum black, K–, exposed. Asci fusiform, 80–100 × 10–12 µm. Ascospores fusiform, 5-septate, without constriction at septa, 15–30 × 5–7 µm, colorless. Pycnidia not observed.

Chemistry — Spot test reactions: thallus K–, C–, KC–, P–. Secondary metabolites: none detected.

Distribution & ecology — Neotropical (Lücking 2008); new to Vietnam. At the collection site the species was found growing on the understory leaves in lowland tropical rain forest at an elevation of 780 m.

Specimen Examined – **VIETNAM**: **Quang Binh Province**: Vườn quốc gia Phong Nha-Kẻ Bàng, 17°28′42.10″N, 106°27′35.60″E, alt. 780 m, on leaf of *Rhaphidophora*, 06 February 2010, T. Nguyen 100080a (KoLRI).

Remarks — Many *Porina* species have been reported from Vietnam (Aptroot & Sparrius 2006). Here we compare *P. subnitidula* with those having blackish, brownish or colorless involucrellum (*P. atrocoerulea* Müll. Arg., *P. diaphana, P. nitidula*). *Porina diaphana* differs in having pale yellowish-white perithecia and colorless involucrellum; *P. nitidula* has subglobose perithecia surrounded

by white tomentum, while *P. atrocoerulea* has oblong, 7-septate ascospores. For further descriptions of *P. subnitidula,* see Lücking (2008).

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